said raised portions shaped and dimensioned to penetrate into the bondpad at the selected contact force by a penetration depth equal to a height of the raised portions but less than a thickness of the bondpad [having a height of about 5000Å, said raised portions configured to penetrate into the bondpad to a limited penetration depth] while the surface of the contact limits further penetration of the contact into the bondpad at the selected contact force; and

a conductive trace formed on the substrate in electrical communication with the contact.

93. (amended) The member as claimed in claim 92 [and] wherein the substrate and contact comprise silicon. [are formed of a semiconductor material.]

96. (amended) The member as claimed in claim 92 [and] wherein the raised portions comprise points. [are pointed].

Remarks

Restriction

Applicant elects the species of a silicon substrate and contact. Claims 78-82, 87, 88, 90-93 and 96 are readable on the elected species. Claims 83, 89, 94 and 95 have been canceled.

Rejections Under 35 USC §112

Claims 78-82, 87, 88 90-93 and 96 have been rejected under 35 USC §112, first paragraph, due to the recitations of "recessed metal bond pad", "pointed members" and a "height of about 5000Å". These rejections are respectfully traversed.

Antecedent basis for the term "recessed bondpads" is contained on page 7, lines 19-20; on page 15, lines 18-20; on page 19, line 20; and in Figures 4-6. The term "metal" has been deleted.

The term "pointed member" has been changed to "point". Antecedent basis for "point" is contained on page 9, line 9, and in Figures 4-6.

The term "5000 Å" was originally recited on page 28, line 11, of claim 4. This term has been added to the specification at page 9, line 10 to provide antecedent basis in the claims. Since it was originally disclosed in the claims no new matter has been added.

Rejections Under 35 USC §103

Claims 78-82, 87, 88, 90-93 and 96 have been rejected under 36 USC §103(a) over Elder in a first set, in view of Nakano in a second set, and Blonder et al., Bindra et al. or Anschel et al. in a third set. Claims 78-82, 87, 88, 90-93 and 96 have been rejected under 35 USC §103(a) over Nakano et al. in view of Blonder et al., Bindra et al. or Anschel et al. in a second set.

In response to the §103 rejections, independent claims 78, 87 and 92 have been amended. The amended independent claims define an attachment member adapted for placement in a test apparatus for "a single die". This type of test apparatus is also referred to in the art as a "carrier" or "temporary package". Representative test apparatus are shown in Figures 1, 8, 9, 10 and 11 of the present application. In addition, page 23, line 14 of the specification, incorporates by reference the test apparatus of U.S. Patent No. 5,367,253 (copy attached).

With this type of test apparatus the die and a "substrate" of the attachment member are biased together with a "selected contact force". This feature is now recited in each independent claim. Antecedent basis for "contact force" is provided on page 17, line 27 of the specification, and on column 9, line 39, of the '253 patent incorporated by reference.

To make a reliable electrical connection, the contact force must be sufficient to allow the contact (43-Figure 1)

on the substrate (41-Figure 3) to penetrate an oxide layer covering the device bondpad (see column 9, lines 39-44 of incorporated patent). At the same time, damage to the bondpad and to the die are preferably minimized so that the bondpad does not require re-working. The present invention accomplishes this result by relating the shape and dimensions of the contact to the contact force exerted by the test apparatus. The penetration depth of the contact into the bondpad is thus controlled to insure penetration, but with limited damage to the bondpad.

As shown in Figure 6, and described on page 17, lines 19-30 of the present specification, the raised members 73 are "dimensioned to penetrate into the bondpad by a penetration depth equal to a height of the raised members but less than a thickness of the bondpad". This is accomplished at a "selected contact force" between the die and substrate (i.e., biasing force). However, at the same time a "surface" of the "contact" limits "further penetration" of the "contact" into the bondpad at the "selected contact force".

Each of the independent claims include the above quoted recitations. It is submitted that the cited prior art does not teach or render these features as obvious.

The Elder et al. reference describes a test apparatus that includes contact bumps 24 (Figure 3). As shown in Figure 6 of Elder et al., these contact bumps 24 are pressed into contact with the die 21 by the compression of the elastomer 25 in the assembled socket (col. 4, line 32). In Elder et al. there is no teaching of a penetrating contact. In addition these is no teaching of limiting the penetration depth into the die 21 using the shape and dimensions of the contact bumps 24. Still further, there is no teaching of relating the shape and dimensions of the contact bumps 24 to the contact force exerted by the test apparatus.

The combination of Nakano with Elder et al. also does not suggest "penetration limitation" at a "selected contact force". As previously argued, Nakano is a probe card. With

a probe card a wafer handler presses the probe card against the wafer. The contact forces between the probe card and the wafer can be controlled as required, by adjustments to the wafer handler. On the other hand, with the presently claimed "test apparatus for a single unpackaged die", the contact force must be generated without external control of the test apparatus. Once the test apparatus is assembled with the force applying mechanism (e.g., clamp 89-Figure 11 of present specification), the contact force cannot by varied.

However, the present invention achieves control by forming the "contacts" with "raised portions" adapted to "penetrate" into the bondpad at the "selected contact force". At the same time, the contact includes a surface that limits further penetration at the "selected contact force".

The Nakano contact is a penetrating contact and thus appears similar in structure to the present contact. However, Nakano does not consider the relationship of the contact to the contact force in an assembled test apparatus. Furthermore, the Nakano contact are proportioned and dimensioned such that they could not function in the manner presently claimed. As previously argued, the Nakano protuberances 21 are 10μm in height (page 5, last paragraph). The probe contacts 22 appear to be similarly sized. Probe contacts 22 sized in this manner could only be used with a thick film pad 25. A thick film pad 25 is not as fragile as a thin film bondpad, some of which are only 1μm or less in thickness. The object in Nakano is to penetrate the pad 25, and not to limit penetration depth as a function of "contact force" as presently claimed.

Still further, the present claims recite "a plurality of raised portions" rather than one single probe contact as in Nakano. With multiple raised portions, current can be spread out, while damage can be limited by the dimensions of the raised portions. With one probe contact as in Nakano, the contact would need to be larger to carry the current. However, a larger contact causes more damage to the die.

The Blonder et al. reference is a permanent connection system that requires "bonding of the carrier pads to the chip pads" (col. 2, lines 40-41). Blonder et al does not relate contact force to penetration depth. Rather as explained in column 4, lines 49-55 of Blonder et al., an external mechanical pressure is applied to the chips and carrier. Again this pressure can be mechanically controlled, and a special contact structure to limit the penetration depth as a function of contact pressure is not required.

The Bindra et al. reference describes a separable electrical connection technology that uses interdigitating members 62. Figure 20 illustrates the mechanical connection of the interdigitating members 62 to a solder ball 61. As stated at column 8, lines 37-38 of Bindra et al. a "pressure insertion" is employed. Presumably this pressure could be selected as required, and "penetration limitation at a selected contact force" would not be a consideration with this reference.

The Anschel et al reference has a filing date of June 11, 1993. The present application is a continuation with a priority date of at least June 4, 1991. Accordingly, Anschel et al. is not a proper reference under 35 USC §103.

In addition to the differences between the references and the present invention, Applicants would argue that one skilled in the art would not combine the references in the manner of the Office Action to provide "more reliable contact" (page 5, first paragraph of final Office Action). Admittedly, test apparatus for single dice as disclosed by Elder et al. are known in the art. In a similar manner, penetrating contact structures for device bondpads as disclosed by Nakano, Blonder et al. and Bindra et al. are known in the art. However, the Elder et al. reference states at column 4, lines 32-33 that "The compression of elastomer 25 provides slight scrubbing action which is necessary for good electrical contact". If the reference teaches that the

contact is already good with a scrubbing action, there would be no incentive for improvement using a penetrating contact.

In view of the amendments and arguments, claims 78-82, 87-88, 90-93 and 96 are submitted to be in a condition for allowance and such an action is requested. Should any other issues remain, the Examiner is asked to contact the undersigned by telephone.

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Enclosure: Petition for 60 Day Extension
U.S. Patent No. 5,367,253

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